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# National PDES Testbed Report Series

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## Development Plan Product Data Exchange Network



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National PDES Testbed



Development Plan  
**Product  
Data  
Exchange  
Network**

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COMMERCE

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September 1990





## **Preface**

This document describes a plan to develop a product data exchange network to serve the needs of both international and national PDES / STEP efforts. The Product Data Exchange Network will be an integral part of the National PDES Testbed which was established at the National Institute of Standards and Technology (NIST) in 1988 under the sponsorship of the U.S. Department of Defense Computer-aided Acquisition and Logistic Support (CALs) program. A major goal of the Testbed is to provide technical leadership in a national effort to implement a complete and useful specification for the exchange of product data. This specification must be designed to meet the needs of American industry and the CALs program.

The National PDES Testbed supports and actively participates in the international effort to develop the Standard for the Exchange of Product Model Data (STEP). The STEP development effort is lead by the International Organization for Standardization (ISO) TC184/SC4.

This plan describes one of several technical project threads that have been established for the National PDES Testbed. Other threads address such areas as:

- development of testing systems to validate the proposed standard,
- specification and testing of application protocols,
- construction of a prototype STEP-based manufacturing cell,
- develop configuration management systems and services, and
- development of conformance testing systems.

The level of support provided for these technical threads and others will be determined by sponsor needs and a number of different priorities. As such, the development plan contained within this document outlines a reasonable schedule to accomplish the objectives of the thread. Changes in priorities and levels of support may either accelerate or delay the proposed schedule. This plan will be updated periodically to reflect technical changes in the project, current level of effort, and expected continued support.

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CALs PDES Manager  
NIST

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# Contents

Preface . . . . .	iii
Executive Summary . . . . .	1
1 Goals and Objectives . . . . .	3
2 Product Data Exchange Network Overview . . . . .	5
3 Technical Plan . . . . .	15
4 Resources . . . . .	23
4.1 Personnel . . . . .	23
4.2 Equipment . . . . .	24
4.3 Facilities . . . . .	24
Glossary . . . . .	25
References . . . . .	27



## **Executive Summary**

The National PDES Testbed (NPT) project of the National Institute of Standards and Technology (NIST) in Gaithersburg, MD was established to support development and validation of the emerging Standard for the Exchange of Product Model Data (STEP). This international standard will provide a mechanism for product data representation and exchange throughout the product's lifecycle. Product Data Exchange using STEP (PDES) is the organizational activity within the United States which ensures that requirements of U.S. industry are incorporated into STEP. Through its testing and validation activities, the National PDES Testbed has assumed a critical role in development of the STEP standard. This document outlines a plan for a Product Data Exchange Network (PDEN) which will help accelerate the development, testing, and validation of STEP and ensure that STEP will function as intended in actual manufacturing environments.

The Product Data Exchange Network will consist of manufacturing facilities and research centers from industry, academia, and government linked electronically via computer networks. The intent of this network is to accelerate the development, validation, and implementation of the STEP standard by distributing development, testing, and validation activities throughout a broad spectrum of manufacturing enterprises. The National PDES Testbed at NIST will serve as headquarters for the Product Data Exchange Network. A specific objective is to have representatives from each of the various manufacturing domains, such as aerospace, shipbuilding, apparel, sheet metal product, electrical product, mechanical product, etc., participate in this program in order to provide technical expertise not available at NIST. Several of the network sites will also serve as model facilities for developing STEP-based manufacturing systems.

Organizations which participate as PDEN members will realize the far-reaching potential of an accepted STEP standard and will maintain a competitive edge through knowledge and application of this technology. As PDEN and the Computer-aided Acquisition and Logistic Support (CALS) Test Network sponsored by the U.S. Department of Defense have similar objectives, the activities and results of these two programs will enhance and complement each other.

Various Product Data Exchange Network sites will perform STEP validation activities based upon specific capabilities available at that site. These activities may include testing or developing STEP-based software applications, developing transition plans to implement STEP in manufacturing environments, or producing actual parts using STEP-based manufacturing systems. NIST will provide support to each network site through program management and orientation, coordination of testing between network sites, and distribution of a Product Data Exchange Network site kit. The PDEN site kit will consist of STEP software tools and background information. The site kit is intended to provide each site with a start-up point. The proposed schedule for the Product Data Exchange Network program indicates that development of the network architecture will be finalized and potential PDEN member sites will be identified in mid-1991, with Product Data Exchange Network sites established early in 1992.



# 1 Goals and Objectives

The National PDES Testbed Program of the National Institute of Standards and Technology (NIST) in Gaithersburg, MD was established to support development and validation of the emerging Standard for the Exchange of Product Model Data (STEP). This international standard will provide a mechanism for product data representation and exchange throughout the product's lifecycle. Product Data Exchange using STEP (PDES), is the organizational activity within the United States which ensures that requirements of U.S. industry are incorporated into STEP. The staff of the National PDES Testbed recognize that establishment of a quality STEP standard can only be achieved with the support and cooperation of private industry, government, and academia. The National PDES Testbed is working to foster close relationships with each of these communities. To further develop these relationships and to accelerate the validation of the STEP standard, this document outlines the formation of a Product Data Exchange Network (PDEN).

The Product Data Exchange Network will be composed of industry, academia, and government partners. These organizations could be government research laboratories, commercial software developers, not-for-profit research organizations, universities, Department of Defense (DOD) manufacturing facilities, or private industry.

The primary goal of the Product Data Exchange Network will be to accelerate the development, validation, and implementation of STEP. The PDEN will achieve this goal by initiating a program to distribute STEP validation activities across a broad spectrum of manufacturing enterprises, to promote the development of STEP software, and to initiate the transition to STEP-based manufacturing systems. The PDEN will create an organized group of government and industry facilities that can provide the knowledge and skills necessary to perform validation and testing activities required for development of a STEP standard. Network site staff will possess specialized expertise in various areas of product design or manufacturing that may not be available at NIST. This expertise will be used to develop test scenarios specific to particular areas or types of product information. A specific objective of the PDEN is to include representatives from many of the various manufacturing domains, such as aerospace, shipbuilding, apparel, sheet metal product, electrical product, mechanical product, etc., in this program in order to ensure that STEP will function as intended in each manufacturing environment.

As well as accelerate the validation of the STEP standard, the Product Data Exchange Network will also provide a more thorough testing of the STEP standard, enable a transition from the STEP standard to STEP-based computer aided manufacturing applications, and provide valuable experience with the STEP methodology and data structures to a wider cross-section of industry. Network sites will also become model facilities to showcase manufacturing applications (CAD, CAM, NC) that use STEP data and provide technical expertise to other STEP validation and implementation efforts. These results will directly benefit industry, and PDEN members in particular, through an increased capability to apply current information technology to the problems of factory automation.

The goals and objectives of the Product Data Exchange Network are similar to those of the Computer-aided Acquisition and Logistic Support (CALS) Test Network sponsored by the U.S. Department of Defense. The CALS Test Network is concerned with testing, evaluation, and demonstration of digital exchange of technical information between

industry and government using standards specified by the CALS program [CALS89a, CALS89b]. While both the CALS Test Network and the Product Data Exchange Network are concerned with exchange of product data, the CALS standards also specify exchange formats for other types of data, including technical publications (i.e., textual documents with illustrations, images, and tables) and logistic support analysis data (i.e., weapon system support information). When available for production use, STEP will be included as a CALS standard for exchange of product data, such as engineering drawings. The primary area of emphasis for the CALS Test Network is to validate and experiment with existing standards. The primary area of emphasis for the Product Data Exchange Network will be to develop, test, and validate an emerging standard, i.e., STEP. The expected member sites of the two networks will not necessarily be the same. Although each network has a different emphasis, the activities of each network will enhance and complement the other.

## **2 Product Data Exchange Network Overview**

The STEP standard for product data representation and exchange provides a mechanism for the integration of product design, manufacturing, and other related activities. Specifically, the goal of STEP is to communicate a complete product model with sufficient information content so as to be directly interpretable by advanced CAD/CAM/CAE/CAI/CAX (i.e., Computer Aided-Design/Manufacturing/Engineering/Inspection/etc.) applications throughout the product's lifecycle (see Figure 1). To ensure that this emerging international standard will function as intended in actual manufacturing environments, several STEP validation activities have been initiated. Current validation efforts have been somewhat limited in scope, however, in order to obtain meaningful results in a reasonable timeframe. The National PDES Testbed program at the National Institute of Standards and Technology (NIST) has established the Product Data Exchange Network (PDEN) to expand the scope of STEP validation activities and ensure that STEP will accommodate most manufacturing domains. The following information provides a high-level overview of the objectives, activities, participants, and benefits of the Product Data Exchange Network.

### **What is the Product Data Exchange Network?**

The Product Data Exchange Network will consist of industry, academia, and government partners with the primary goal of accelerating the development, validation, and implementation of the STEP standard for product data representation and exchange.

Industrial and academic sites from both small and large organizations will be able to participate in the Product Data Exchange Network. A specific objective is to have representatives from each of the various manufacturing domains, such as aerospace, shipbuilding, apparel, sheet metal product, electrical product, mechanical product, etc., participate in this program. Each member of the Product Data Exchange Network will fill a specific technical niche in the development of the STEP standard. As the STEP standard and the Product Data Exchange Network evolve over time, it is anticipated that some network sites will become model facilities for STEP-based manufacturing.

Each member site will implement a pre-packaged software system that can read the STEP Specification and manipulate STEP-formatted data. These software tools will then be used to evaluate the completeness and correctness of the STEP standard in each particular manufacturing environment. This activity will be performed through a variety of methods using typical product data required to support advanced manufacturing applications.

The Product Data Exchange Network is funded through the U.S. Office of the Assistant Secretary of Defense Computer-aided Acquisition and Logistic Support (CALs) Program. Implementation of the Product Data Exchange Network is developed and coordinated through the National PDES Testbed Project at the National Institute of Standards and Technology (NIST). A Memorandum of Understanding (MOU) will be developed between NIST and each Product Data Exchange Network site. Each network site will work with NIST to create a site development plan. The site development plans will outline the level of participation of each network site, the activities to occur at that site, and the types of STEP systems to be demonstrated by each site.

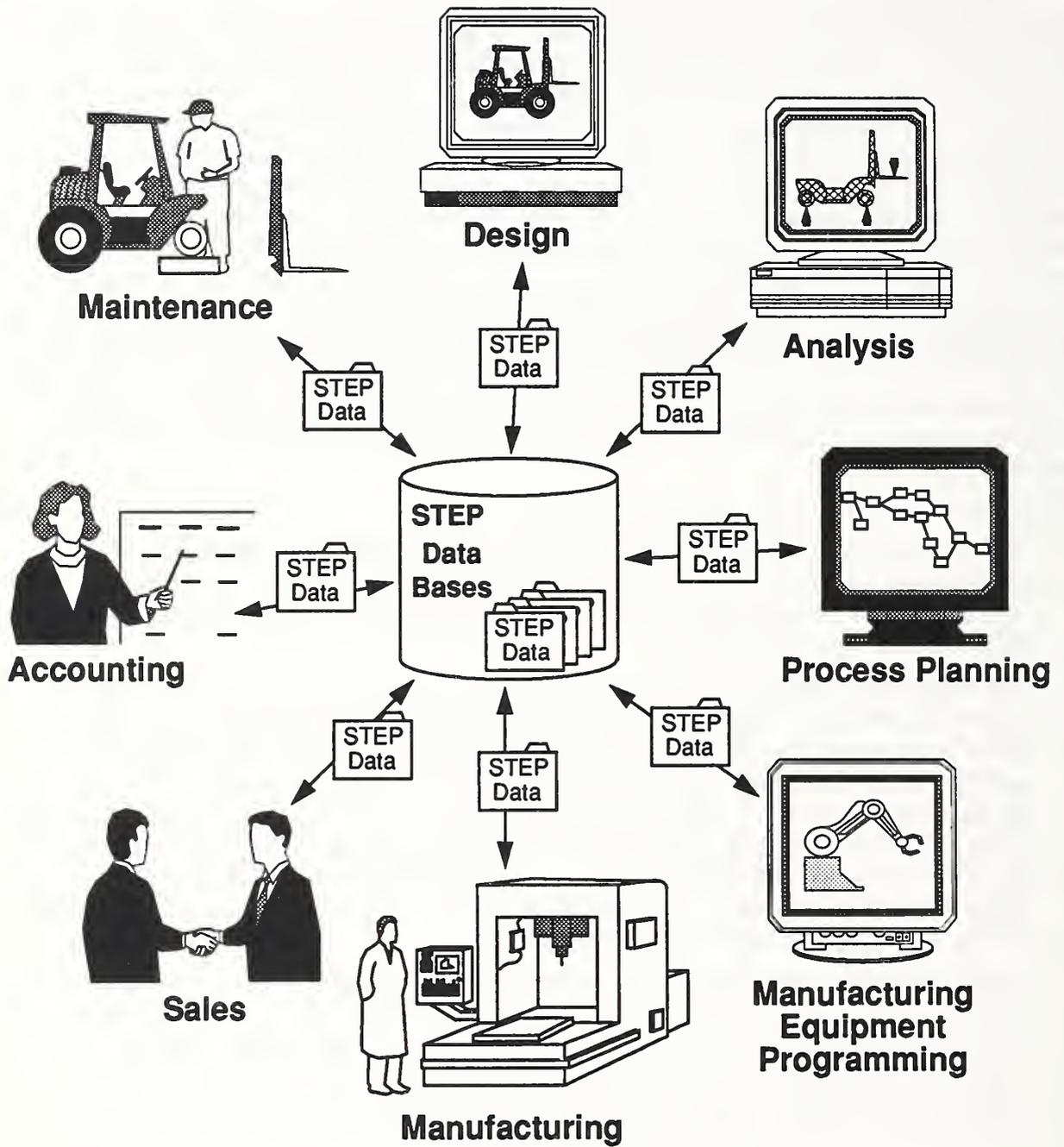


Figure 1. STEP Data Transfer Between Applications

## What will the Product Data Exchange Network accomplish?

Expected accomplishments of the Product Data Exchange Network are outlined below. These accomplishments will directly benefit industry by ensuring a usable STEP standard that provides a framework for the exchange of product data across different applications in the manufacturing environment. Specifically, the Product Data Exchange Network will:

- Accelerate the development, validation, and implementation of the STEP standard
- Provide a more thorough testing of the STEP standard (resulting in higher quality)
- Enable transition from the STEP standard to STEP-based manufacturing systems
- Provide valuable experience with the STEP methodology and data structure to a wider cross-section of industry

## What kind of organizations will participate as Product Data Exchange Network sites?

Product Data Exchange Network sites will consist of both small and large organizations that are concerned with expanding product data access across various/multiple computer applications to support the manufacture of domain specific products. These organizations will realize the benefits of this international standard and will maintain a competitive edge through knowledge and application of this technology (see Figure 2).

## What are some examples of Product Data Exchange Network sites?

### 1. National Institute of Standards and Technology (NIST)

The National Institute of Standards and Technology (NIST) in Gaithersburg, MD is tasked with establishment, development, and coordination of the Product Data Exchange Network. A wide range of STEP validation efforts are already in place within the National PDES Testbed Project at NIST [Strouse90]. These efforts include development of STEP-based software tools (e.g., filters, translators, data modeling tools, editing tools, etc.) [Clark90a, Clark90b], prototype implementations of STEP-based manufacturing systems [Fowler90], validation of the STEP Specification within specific applications, and numerous other activities. With the availability of the Automated Manufacturing Research Facility (AMRF), NIST has the capability to perform all functions currently involved in STEP validation. The NIST facility will serve as the initial model for development of other Product Data Exchange Network sites

### 2. South Carolina Research Authority (SCRA)

Similar to the NIST PDES Testbed Project, the primary objective of the PDES, Inc. industrial consortium is to accelerate STEP development, validation, and implementation. This program is managed by the South Carolina Research Authority (SCRA) and consists of technical representatives from several member companies. In addition, NIST participates in PDES, Inc. as a government associate. The activities of PDES, Inc. typically involve development of STEP-based software tools and validation of the STEP Specification within selected applications. It is

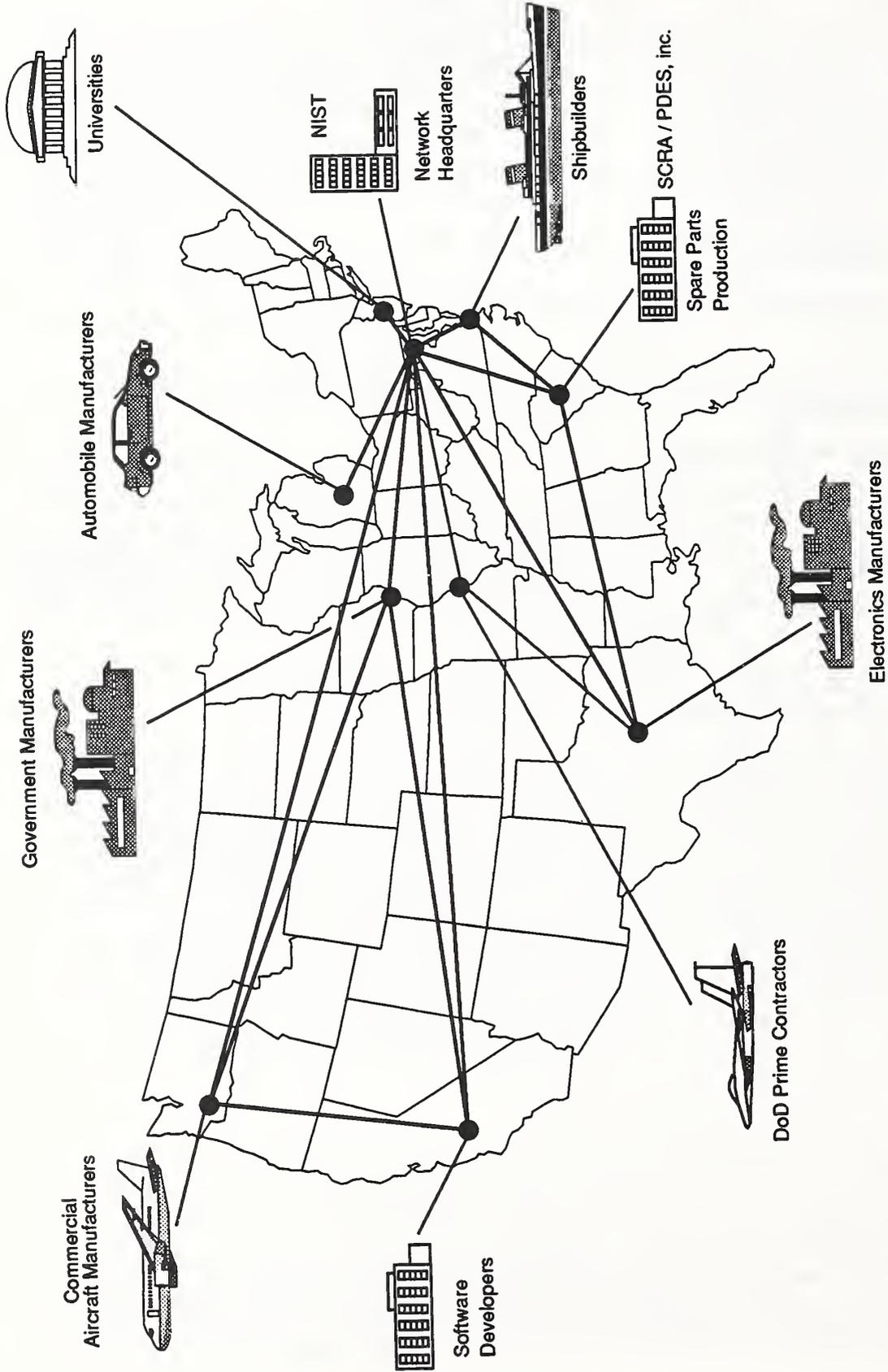


Figure 2. Possible Product Data Exchange Network Sites

anticipated that a Product Data Exchange Network site will be established at the SCRA facility in Charleston, SC. This SCRA facility is also home to the Rapid Acquisition of Mechanical Parts (RAMP) Project manufacturing workcell which serves as a prototype for STEP-based manufacturing systems.

3. Representatives of various manufacturing domains from the following site classifications: (Note that all site classifications are not expected to have all STEP validation capabilities)
  - Government Manufacturing Facility
  - Government Research Laboratory
  - DoD Prime Contractor
  - Private Industry, e.g.:
    - Automobile Manufacturing
    - Aircraft Manufacturing
    - Shipbuilding
    - Electronics Manufacturing
  - Independent Research Organization
  - University
  - Software Development Organization

#### **What benefits will a Product Data Exchange Network site receive?**

Each Product Data Exchange Network site will receive several benefits from participation in this program. The most evident benefit will be the knowledge and expertise gained in evaluating the STEP standard and implementing STEP in a manufacturing environment. Personnel experienced in the STEP methodology and data structure can provide the Product Data Exchange Network site with an increased capability to apply current information technology to the problems of factory automation. This knowledge will also provide potential near-term integration of existing manufacturing systems, with the ability to rapidly implement next-generation commercial STEP-based systems when available.

For those organizations concerned with contracts of the U.S. Department of Defense (DOD), use of the STEP standard will be required in the future for contractors to comply with the DOD CALS initiatives for electronic information exchange. Participation as a Product Data Exchange Network site would provide the background necessary to develop or acquire software systems to meet this requirement.

#### **What are example activities that a site may perform?**

Each Product Data Exchange Network site will perform STEP validation activities based upon specific capabilities available at that site (see Figure 3). All sites will not be expected to perform all types of development, validation, and testing activities.

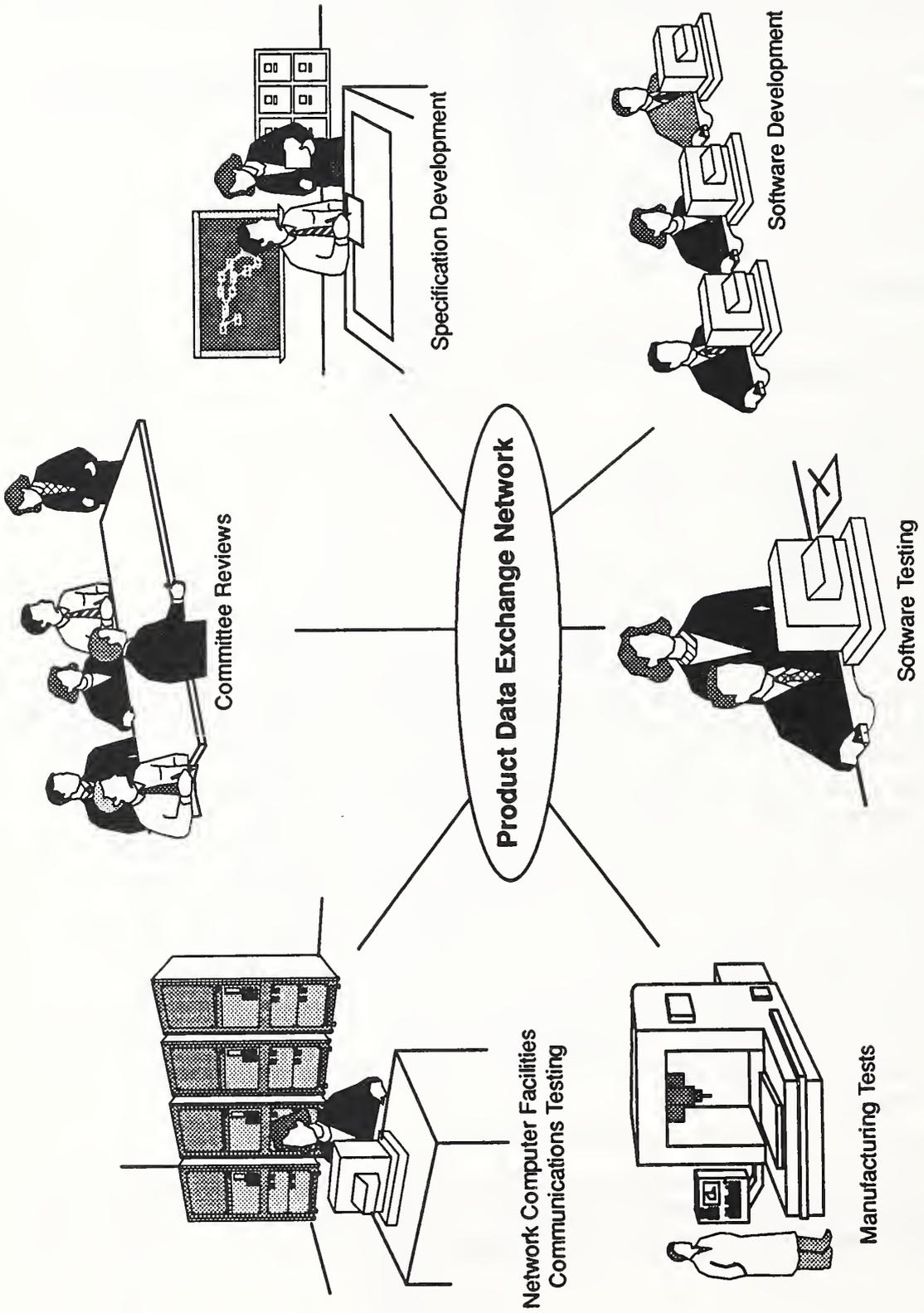


Figure 3. Types of Activities Which May Occur at Different PDEN Facilities

**Develop Test**

- Design test scenario
- Set up test environment
- Create data
- Prepare data
- Send data
- Document shipment
- Verify receipt of shipment

**Execute Test**

- Set up test environment
- Receive data
- Process data
- Evaluate results
- Analyze problems
- Report results

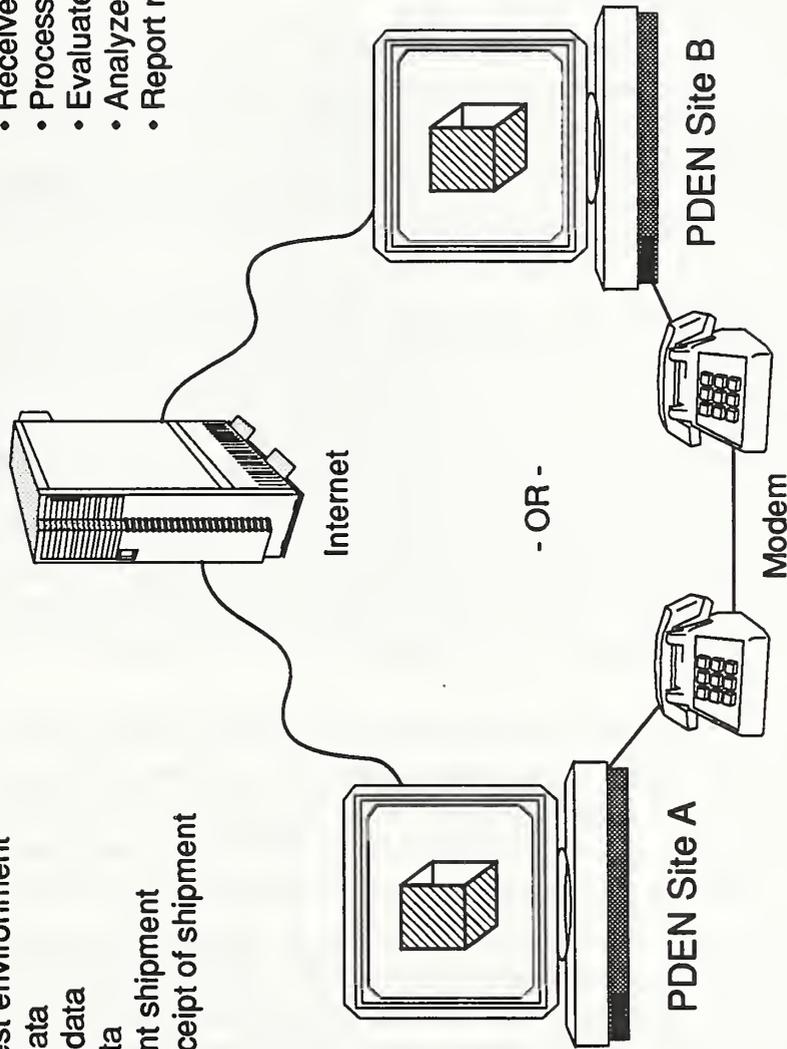


Figure 4. STEP Data Exchange Test

Almost all sites, however, will perform STEP data exchange tests (see Figure 4). Example activities that a site may perform are outlined below.

- Determine software requirements to develop and implement STEP-based manufacturing systems in each specific environment
- Develop STEP-based manufacturing system software
- Develop transition plans to implement the STEP Specification in an actual manufacturing process
- Develop process specifications to use STEP-based manufacturing systems
- Produce parts using STEP data
- Test STEP-based software applications
- Perform exchange testing between Product Data Exchange Network sites to ensure compatibility between applications
- Perform conformance testing of STEP-based commercial systems
- Provide technical expertise to other STEP validation or implementation efforts

#### **What expenses will be incurred by a Product Data Exchange Network site?**

The expenses incurred by each Product Data Exchange Network site will be determined from the level of involvement selected by the site. It is not expected that all sites commit equal amounts of resources to this program. The cost categories that a Product Data Exchange Network site will be responsible for include site staff costs, facility space, and purchase of necessary computer hardware and site-specific application software (i.e., CAD/CAM software). In addition, use of existing computer data networks (if present) will be required to communicate with remote sites. If these computer data networks are not present, installation of these networks is the responsibility of the Product Data Exchange Network site.

#### **What support will NIST provide to a Product Data Exchange Network site?**

As developer and program coordinator of the Product Data Exchange Network, the National Institute of Standards and Technology (NIST) will perform the following activities to support the STEP-related activities at each network site:

- Develop, assemble and distribute Product Data Exchange Network site kit  
The Product Data Exchange Network site kit will consist of STEP-based software tools (e.g., filters, translators, data modeling tools, editing tools, etc.), computer hardware requirements, a program presentation package, training materials, and recommended site staff skill composition.
- Establish communications with network sites
- Conduct communications tests with network site
- Provide program orientation seminars, hardware/software installation assistance, and software training
- Coordinate testing between testbed network sites

- Develop program schedules, conduct project meetings, and provide overall program management
- Distribute information and technology updates
- Provide guidance, direction, and consultation and serve as a focal point for problems and concerns
- Organize and conduct demonstrations of STEP activities at network sites
- Initiate transition of selected sites to STEP-based production

**What will be the physical appearance of a Product Data Exchange Network facility?**

Each Product Data Exchange Network facility will primarily consist of an office environment equipped with computer hardware, software, and some type of network access. The computer software will be largely supplied by NIST in the Product Data Exchange Network site kit. The computer hardware, however, is specified by NIST, but purchased or obtained by each site. Existing computer networks may be used at each site if available, but capability to electronically link to other Product Data Exchange Network sites (via modem or network) must be present. A Product Data Exchange Network site may find that access to a manufacturing facility would be advantageous for some STEP validation activities. This type of facility is not required, however, for a network site to benefit from this program.



### 3 Technical Plan

The development of the Product Data Exchange Network (PDEN) will parallel the progress of the PDES and STEP efforts. The needs of the PDES community will change as STEP standards evolve, as software vendors introduce STEP-based commercial products, and as manufacturers change over to STEP compatible systems and procedures. As the development of STEP proceeds, the role of the PDEN will change to conform to the anticipated needs of the standards development community, commercial software vendors, DOD manufacturing facilities, and private industry.

The initial role of the Product Data Exchange Network will be to promote the development of STEP-based software systems and utilities (e.g., filters, translators, data modeling tools, editing tools, etc.). In 1991, the PDEN intends to establish a small university grants program, and some contracts may be initiated with private software developers to produce STEP-based software systems and utilities required for the development of the STEP standard. The Product Data Exchange Network will provide data to commercial software developers to aid in the development and testing of software systems. As STEP-based systems become available, the PDEN will establish network sites at private industry and government manufacturing facilities. These sites will serve as development, testing, and validation centers during the development of STEP. Initial network sites will be established by PDEN staff in early 1991. Site staff will demonstrate STEP file transfers and software tools for manipulating STEP data. A number of network sites will serve as test cases in the transition to STEP-based manufacturing. These sites will serve as models to formulate the requirements and procedures necessary to transition manufacturing facilities using current technology to STEP-based manufacturing facilities. At these facilities, product data information will be transferred between the major software applications (i.e., design, process planning, manufacturing engineering, scheduling, production, inspection, testing, and field support) via computer systems adhering to STEP standards.

A Work Breakdown Structure (WBS) for the Product Data Exchange Network, an outline of PDEN deliverables, and a timeline of the required project tasks are given in Figures 5, 6, and 7, respectively.

#### Task Descriptions

- PDEN 0      Prepare a Development Plan for the Product Data Exchange Network**  
This Development Plan has been produced by the National PDES Testbed (NPT) to provide an overview of the tasks required to establish a product data exchange network and transition the network sites to STEP-based production. The development plan will outline the necessary tasks and deliverables associated with each task. The plan will also identify the personnel and equipment required and provide a timeline of activities. This Development Plan will be published as a NISTIR.
- PDEN 1      Disseminate Information on PDES, STEP, CALS, and the National PDES Testbed**  
National PDES Testbed staff will develop a National PDES Testbed information packet and education/demonstration packet. The information packet will consist of brochures and representative published papers that

will provide background information on the National PDES Testbed and give an overview of its functions. The education/demonstration packet will consist of a computer-based interactive overview of the testbed for use either by individuals for self teaching or by management for presenting overviews of the testbed. This may also extend into self-running demonstrations. These types of systems will help give potential network sites and personnel a head start in understanding the scope of the information exchange problem addressed by PDES/STEP and the role of the Product Data Exchange Network

**PDEN 2      Develop a program for Product Data Exchange Network sites**

The National PDES Testbed will develop a program for the network and will establish initial site(s) to validate proposed network plans. The initial network site(s) will perform communications testing and testing of PDES software tools currently under development by NIST. National PDES Testbed staff will use this experience to finalize plans for the network. These initial site(s) will serve as a model for subsequent expansion of the Product Data Exchange Network.

**PDEN 3      Initiate competitive grants program to promote development of STEP software utilities**

The National PDES Testbed will contract with several software developers to produce some of the software tools required for testbed activities. The NPT will also establish a small competitive grants program aimed at universities. Research labs would submit proposals for developing STEP-related software systems. Each grant would be of limited scope, but would address a particular need of the National PDES Testbed or the STEP community.

**PDEN 4      Create product data exchange library and information exchange network**

The National PDES Testbed at NIST will serve as a control point and data repository for software systems developers connected to the PDEN. PDES testbed staff will collect and maintain product information from various sources and in various formats. Software developers will use this example data in developing and testing their systems.

National Testbed staff will also work to develop remote XWindow capabilities for shared work in the area of document annotation. This system will allow multiple collaborating individuals to view and make comments on electronic documents. This would greatly increase the coordination among technical teams and experts both for software development and standards development [Ressler90].

**PDEN 5      Hold organizational workshop for potential Product Data Exchange Network members**

Plan and organize a workshop for prospective network member sites. Network members will be recruited from among DOD manufacturing facilities and private sector facilities with ties to DOD. Prospective sites

must meet the facility and staff requirements set down by the National PDES Testbed management. The workshop will be held at NIST. The purpose of the workshop will be to:

- summarize requirements and costs to become a network member
- outline potential benefits and cost savings of STEP-based manufacturing
- provide information on what they can do now
- summarize necessary staff qualifications
- furnish presentation package to pitch to management and VIPs
- outline training requirements for network site staff

**PDEN 6 Identify initial network sites**

National PDES Testbed personnel will travel to prospective network sites, meet with site staff, and review site facilities. NPT management will then examine the qualifications of prospective member sites. Network sites will be selected based on facility requirements and staff qualifications established by NPT staff. The National PDES Testbed manager will obtain verbal agreements from site representatives of the selected sites. The National PDES Testbed manager will provide a list of the network member sites to the CALS office.

**PDEN 7 Develop network site kit**

National PDES Testbed staff will develop a comprehensive package of materials that will be used to establish network programs at member sites. The package will include:

- orientation outlines
- task agendas
- site team composition (staff requirements)
- list of necessary hardware
- list of required software applications
- software tools developed at National PDES Testbed
- training materials

**PDEN 8 Establish network site(s)**

National PDES Testbed staff will meet with representatives of each of the selected network sites to finalize a memorandum of understanding. The National PDES Testbed will provide the site kit to each of the selected members and work cooperatively with each member site to generate a site development plan. Each member site will establish a network team and will initiate purchases for the required hardware (or designate existing hardware). A Memorandum of Understanding (MOU) will be signed for each network site

- PDEN 9      Make network site(s) operational**  
Network site personnel will install the required hardware and software systems. After this installation is complete, communications will be established between the test site and the National PDES Testbed. Network site team members will then receive the necessary training for using the PDES software tools contained within the site kit. Network sites will issue periodic status reports to the National Testbed.
- PDEN 10     Plan transition of network site(s) to STEP-based manufacturing**  
National PDES Testbed staff and representatives from selected member sites will work cooperatively to produce a requirements document for STEP-based production and a design architecture for STEP-based manufacturing systems at each site. Each member site will develop a transition plan for phasing in STEP-based systems
- PDEN 11     Perform testing and validation activities**  
Each network site will assist the Standards Testing Center of the National PDES Testbed in testing application-specific areas of the STEP standard and validating that the STEP standard will function as intended in each manufacturing domain. The National PDES Testbed will coordinate validation activities with network sites. This will be an ongoing activity. PDEN sites will issue validation and test reports to the National PDES Testbed.
- PDEN 12     Install and demonstrate commercial STEP-based systems at network site(s)**  
Each network site will generate procurement specifications for commercial STEP-based manufacturing systems. Once procurement, installation, and user training are completed, site staff will perform integration and acceptance testing. Each site will give a demonstration of its STEP-based production capabilities.
- PDEN 13     Initiate STEP-based production facility operational testing**  
Once the STEP-based production systems have been installed and initial integration testing is completed, member sites will enter an operational testing phase. Actual part production operations will be completed using these systems. Each member site will issue periodic operational test reports. These reports will be compiled and evaluated by National PDES Testbed staff.

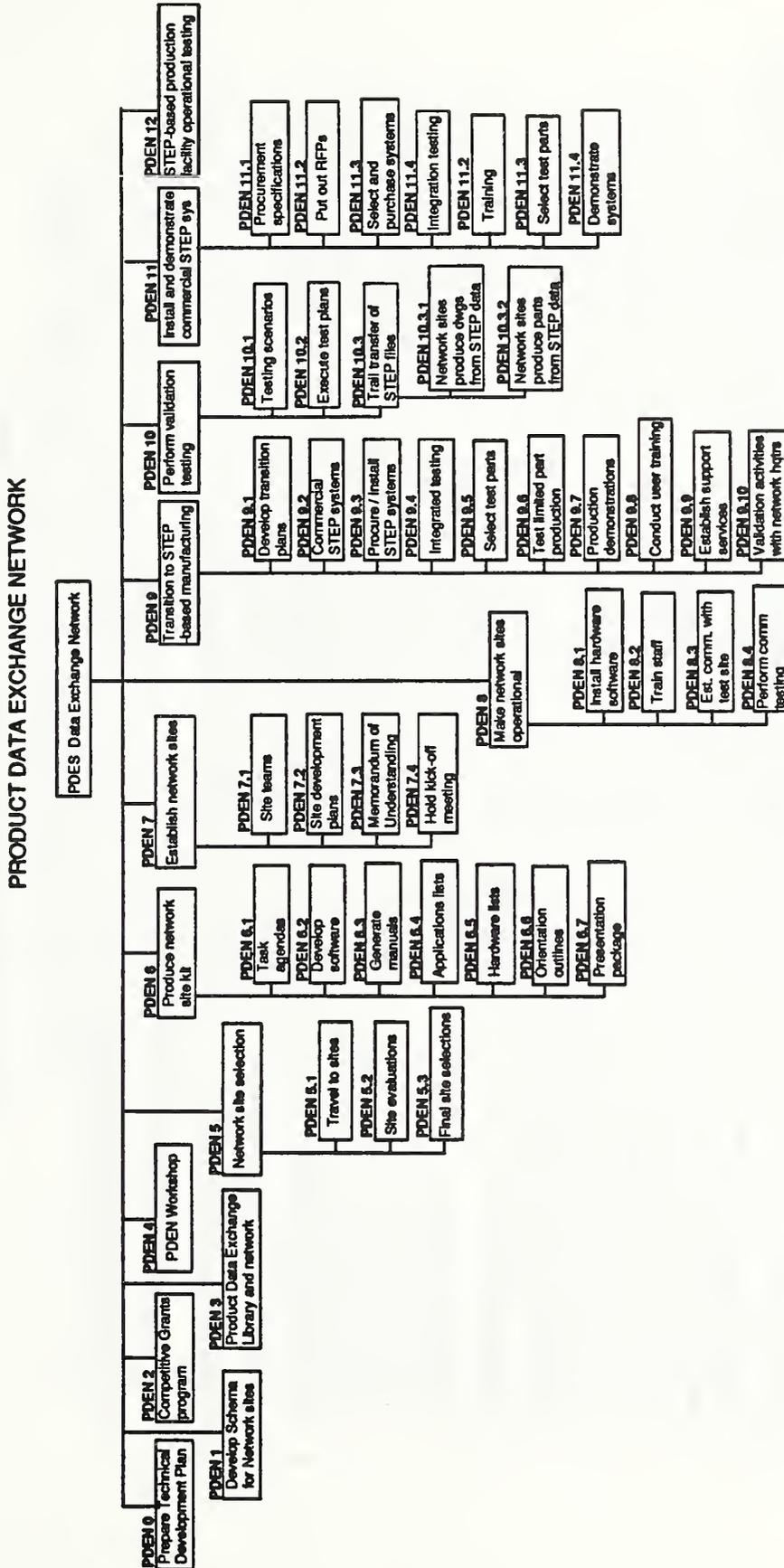


Figure 5. Work Breakdown Structure for Product Data Exchange Network

**DELIVERABLES: PRODUCT DATA EXCHANGE NETWORK**

TASK	START	STOP	DELIVERABLE	SUPPLIER	CUSTOMER
0. Prepare technical development plan	4/90	10/90	PDEN technical Development Plan	PCO	CALS
1. Develop and disseminate PDES information packets	11/90	6/91	Information packets	PCO	Users
2. Develop schema for Network sites	11/90	7/91	PDEN architecture document	PCO	CALS
3. Initiate competitive grants program for STEP software	1/91	3/91	Grants contracts	PCO	NPT
4. Create product data library and info exchange network	4/91	8/91	One-line library at NIST site	PCO	NPT
5. Hold organizational workshop	4/91	10/91	Workshop summary	PCO	CALS
6. Select initial Network sites	10/91	4/92	PDEN site selection report	PCO	CALS
7. Produce network site kit	10/91	4/92	Network site kit	PCO	CALS
8. Establish network site(s)	4/92	1/93	PDEN site report	PCO	CALS
9. Make network site(s) operational	1993	1993	PDEN site reports	PCO	CALS
10. Plan transition to STEP based manufacturing	1994	1994	Transition Plans	PCO	CALS
11. Perform validation testing	1996	1996	Integration test reports	PCO	CALS
12. Install and demonstrate commercial STEP systems	1996	1996	Installation report	Member site(s)	CALS
13. STEP based production facility operational testing	1990	1998	Production demonstrations	PCO	CALS

**Figure 6. Deliverables for Product Data Exchange Network**

# Product Data Exchange Network

## Project Schedule

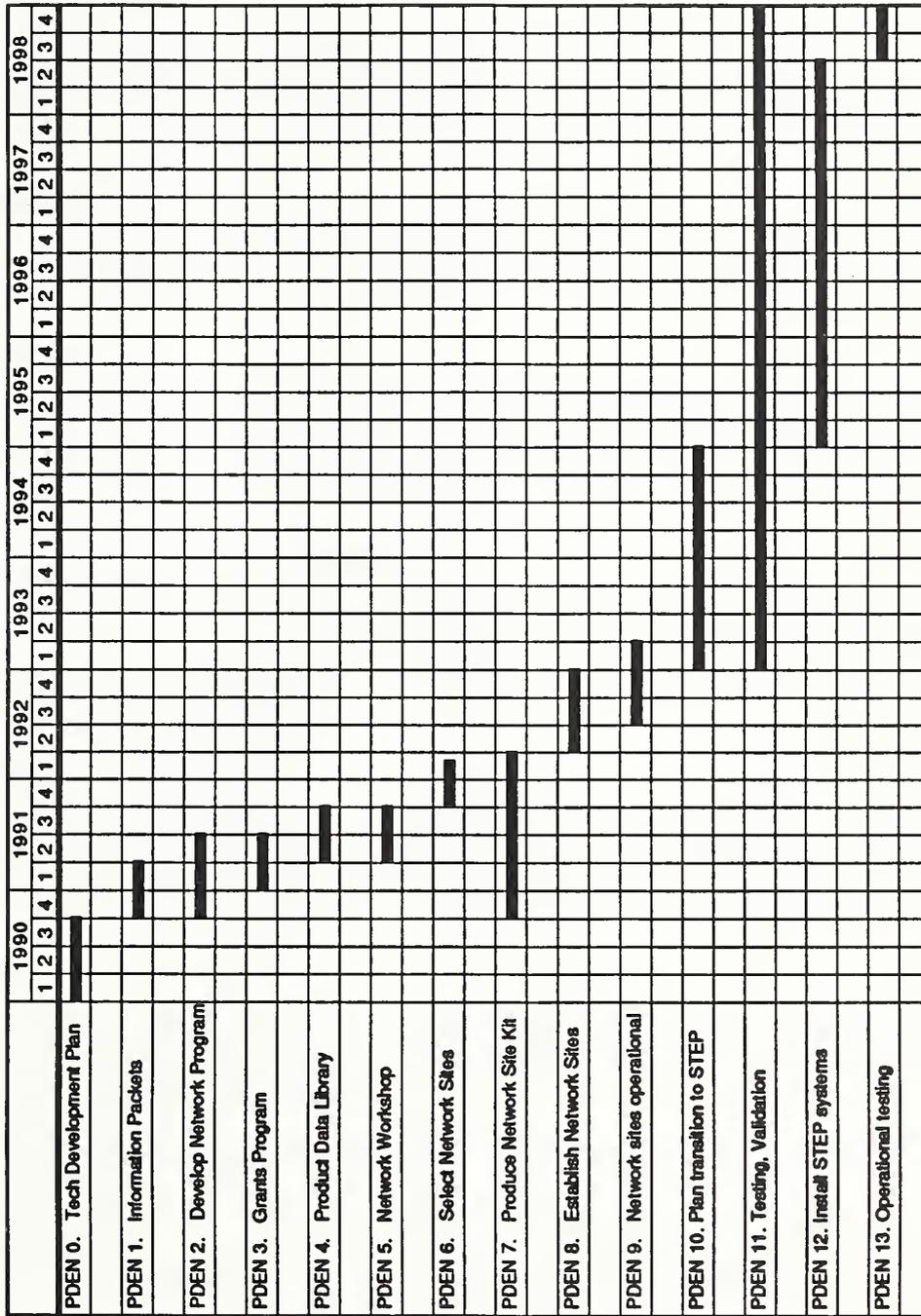


Figure 7. Timeline for Product Data Exchange Network Activities



## **4 Resources**

### **4.1 Personnel**

This section outlines the personnel roles within the National PDES Testbed that are required for the development of the Product Data Exchange Network.

#### **Network Manager**

Responsible for developing conceptual plans, supervising network formation, establishing network goals and objectives, managing network activities. The network manager is also responsible for assigning work to network staff, meeting scheduled milestones, and reporting on network activities.

#### **Network Administrator**

Responsible for scheduling network activities such as workshops, meetings, testing operations, and demonstrations. Responsible for day-to-day operations of the network.

#### **Systems Analyst**

Responsible for designing network architecture and outlining network organization. Plans transition of network sites to STEP-based manufacturing. Perform requirements analysis, generate system specifications, develop transition plans.

#### **Manufacturing Systems Engineer**

Develops requirements and specifications for manufacturing systems. Develops test scenarios, selects test parts. Assists in planning demonstrations. Must be knowledgeable in CAD/CAM, manufacturing computer systems, manufacturing processes.

#### **Software / Test Engineer**

Manages development of software tools for network. Directs installation of network communications systems. Develops test programs and design testing software. Assists in development transition plans, requirements analysis, and system specifications. Helps install network systems at member sites.

#### **Programmer**

Design and implement software tools for National PDES Testbed and network sites. Develop custom software for integration commercial applications.

#### **Communications Technician**

Implement network communications with network sites. Perform required maintenance on network communication systems.

#### **Support Staff**

Perform clerical activities to support network activities.

## 4.2 Equipment

This section lists the possible computer hardware, computer software, and manufacturing shop equipment required for development of the Product Data Exchange Network. Note that details of the computer hardware and software requirements will be specified in the PDEN Site Kit.

### Computer Hardware

- Unix workstations
- Personal Computers
- Local, Wide-Area, and Inter-Site Networks
- Laser Printers

### Computer Software

- PDEN Site Kit software (supplied by NIST)
- Commercial Computer Aided Design (CAD) packages
- Commercial Computer Aided Manufacturing (CAM) packages
- Commercial database management systems

### Manufacturing Equipment

- Machine tools, inspection equipment, foundry, sheet-metal processing, welding, plastics, or electronic component production equipment, etc. with associated controllers and interfaces (Note: this equipment is only applicable to PDEN sites which will participate in production tests)

## 4.3 Facilities

### NIST National PDES Testbed Facility

The PDEN may require use of the computer systems and communication resources available at the NIST facility.

### PDEN Site Office Area

Each PDEN site will require an office area for use by PDEN personnel. Most STEP validation activities can occur in an office environment.

### PDEN Site Manufacturing Shop

A PDEN site may require access to a manufacturing facility to develop prototypes of STEP-based manufacturing systems or to produce actual parts from STEP data.

### NIST Conference Room Facilities

PDEN conferences, workshops, and training seminars will require use of the NIST (or other PDEN site) conference room facilities.

## **Glossary**

### ***CAD***

Computer Aided Design

### ***CALS***

Computer-aided Acquisition and Logistic Support

### ***CAM***

Computer Aided Manufacturing

### ***DOD***

Department of Defense

### ***MOU***

Memorandum of Understanding

### ***NIST***

National Institute of Standards and Technology

### ***NPT***

National PDES Testbed

### ***PCO***

Program Coordination Office (of the National PDES Testbed Program)

### ***PDEN***

Product Data Exchange Network

### ***PDES***

Product Data Exchange using STEP

### ***RAMP***

Rapid Acquisition of Manufactured Parts

### ***SCRA***

South Carolina Research Authority

### ***STEP***

Standard for the Exchange of Product Model Data

### ***WBS***

Work Breakdown Structure



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11. ABSTRACT (A 200-WORD OR LESS FACTUAL SUMMARY OF MOST SIGNIFICANT INFORMATION. IF DOCUMENT INCLUDES A SIGNIFICANT BIBLIOGRAPHY OR LITERATURE SURVEY, MENTION IT HERE.) The National PDES Testbed (NPT) project of the National Institute of Standards and Technology in Gaithersburg, MD was established to support development and validation of the emerging Standard for the Exchange of Product Model Data (STEP). Through these testing and validation activities, the National PDES Testbed has assumed a critical role in development of the STEP standard. National PDES Testbed staff have begun the development, of a Product Data Exchange ~~XXXXXXXX~~ Network (PDEN) which will help accelerate the development, testing, and validation of STEP and help ensure that STEP will function as intended in actual manufacturing environments. This document outlines a plan for the development of such a Product Data Exchange Network.

The Product Data Exchange Network will consist of manufacturing facilities and research centers from industry, academia, and government linked electronically via modems or computer networks. The intent of this network is to accelerate the development, validation, and implementation of the STEP standard by distributing development, testing, and validation activities throughout a broad spectrum of manufacturing enterprises. The National PDES Testbed at NIST will serve as headquarters for the Product Data Exchange Network. Organizations which participate as PDEN members will realize the far-reaching potential of an accepted STEP standard and will maintain a competitive edge through knowledge and application of this technology.

12. KEY WORDS (6 TO 12 ENTRIES; ALPHABETICAL ORDER; CAPITALIZE ONLY PROPER NAMES; AND SEPARATE KEY WORDS BY SEMICOLONS)

STEP; PDES; NIST; Product data; Network; Manufacturing; CALS; Software testing

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